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National Field Research Center, Inc, Iowa City, IA

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WORKFORCE ASSESSMENT
PHASE III

PRIVATE SECTOR TRAINING ACTIVITIES

1979

Conducted by:
NATIONAL FIELD RESEARCH CENTER, INC.

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This report is one of 18 volumes in Phase III of the National Environmental/Energy Workforce Assessment. Based on insights developed during Phases I and II of the Assessment, Private Sector Training Activities describes the nature of environmental training activities in the private sector, identifies problems and issues of private sector training, and introduces additional areas for thought and discussion. The chief objective of the report is to highlight problems in getting educational institutions and private industry to work in coordination with one another in providing skills to persons who work in environmental jobs.

In addition, Phase III includes 12 volumes (directories) of post-secondary environmental education programs. The other 5 volumes in Phase III are as follows: Salaries and Attendant Problems of Public Sector Environmental Employment; The Role of CETA in Direct Training and Employment; Problems in Environmental Education and Training; Environmental Employment in Public Service Jobs Programs, and a Workforce Planning Bibliography.

Phase I of the Assessment evaluated workforce needs for pollution control and abatement in the U.S. during 1976-81. Phase II gathered data on training and educational programs in the post-secondary environmental education field as of 1978.

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INTRODUCTORY NOTE

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TABLE OF CONTENTS

ACKNOWLEDGEMENT..... vii

PROJECT BACKGROUND..... 1

INTRODUCTION 6

Summary of Phase I - Private Sector..... 10

Summary of Phase II - Private Sector..... 16

REVIEW OF LITERATURE..... 22

DESCRIPTION OF PHASE II PARTICIPANT TRAINING ACTIVITIES..... 28

ISSUES..... 36

I. Occupational Titles Raise Semantic Issues..... 37

II. Training Needs to be Matched With On-the-Job Skill Requirements..... 40

III. Educators and Private Sector Need to Align Priorities and Synchronize Efforts..... 42

PROJECT COMMENTARY..... 45

APPENDICES..... 48

1. Sample of Information Requested during Phase I..... 48

2. Sample of Information Requested during Phase II..... 50

3. Organizations Participating - Phase II Private Sector..... 52

4. Organizations Contacted - Phase II Business & Industry..... 54

BIBLIOGRAPHY..... 61

TABLE

1. COMPANIES INCLUDED IN SAMPLE BY CATEGORY AND REGION..... 13

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A special word of appreciation is extended to Mr. J. Donald Cook, Chief, Workforce Coordination Team, U.S. Environmental Protection Agency, Washington, D.C., and to the Manpower Officers and Workforce Coordinators from each of the U.S. Environmental Protection Agency Regional Offices.

PROJECT BACKGROUND

Overview

The National Environmental/Energy Workforce Assessment is a three-phase project to explore environmental and energy training, education, and employment in depth. The project, conducted by National Field Research Center, Inc., under the direction of the U. S. Environmental Protection Agency, is a direct response to a 1975 Congressional call for an inquiry into the availability and readiness of our national workforce for increased pollution control and abatement efforts.

In keeping with the objectives of the inquiry, this nation-wide study has been directed toward the assessment of environmental/energy workforce status and needs, national educational emphases and status, and the functional interface of the two.

PHASE I

Phase I focused upon the development of "workforce demand projections" through 1982 for all public environmental agencies. The on-site assessment culminated in a numerical profile of the growth patterns and workforce needs at the national and state levels. Stratification of the overall defini-

tion of "environmental occupation" into seven distinct vocational areas enhanced even further the applicability of the results. In addition to this public sector workforce assessment, Phase I included an overview analysis of private sector needs (conducted through an adjunct mail survey of selected businesses and industries) and a brief review of selected environmental educational programs.

Phase I was completed in May, 1977. The 70 volume final report included:

National Abstract	(1)
National Legislation	(1)
Regional Assessments	(10)
State Assessments (including District of Columbia, Virgin Islands, and Puerto Rico)	(53)
Business and Industry Assessment	(1)
National Summary	(4)

PHASE II

The Phase II objective was to determine the "state of the art" of the educational community in generating a qualified and employable environmental workforce. Community colleges, vocational-technical training institutes, colleges and universities,

and environmental training centers throughout the nation were visited; thousands of catalogs were reviewed.

The result was a profile of environmentally related post-secondary educational programs. Aspects subject to careful review included: program structure, representative course offerings, enrollment projections, program completion requirements, faculty composition, and employment history of program graduates. Program offerings were summarized and common issues and problems were discussed.

The Phase II report included 13 volumes arranged as to medium under consideration, namely:

Air	
Energy	
Noise	
Pesticides	
Potable Water	(2)
Radiation	
Solid Waste	
Wastewater	(2)
Composite	(3)

These volumes were augmented by a summary volume, an abstract, and a special volume, Business and Industry/Trade and Professional Associations.

The latter includes the results of a survey of a variety of businesses, industries, and trade and professional associations as to their efforts in training programs related to pollution control and abatement, environmental research, and resource conservation.

PHASE III

Under Phase III, materials from Phases I and II were analyzed and synthesized. Issues which were revealed to be of special importance to the future of our environmental/energy workforce, in terms of availability and quality, are being highlighted in a series of monographs, of which this is one.

The monographs focus upon salient aspects of the NE/EWA findings in greater detail than possible in the formats of the previous phases. The four monograph titles are:

- *Salaries and Attendant Problems of Public Sector Environmental Employment*
- *The Role of CETA in Direct Training and Employment*
- *Private Sector Training Activities*
- *Problems in Environmental Edu- and Training*

In addition to the four monographs, a report of the issues related to the use of Title VI CETA in carrying out environmental pollution control and abatement activities was developed. A search of the Title VI records on file with the U.S. Department of Labor, coupled with interviews with representatives of numerous prime sponsors provided the basis for the observations contained in that report.

A third objective was to develop, by medium, a listing of all post-secondary institutions offering environmental programs. All catalogs reviewed during Phases I and II were re-examined and replaced with updated versions when warranted. This information was compiled into a listing of schools offering environmental programs of study and organized as to program area. Finally, Phase III researchers developed an annotated bibliography of material of potential value to environmental workforce planners.

INTRODUCTION

Post-secondary environmental and energy related education/training has most typically been described as that which takes place in vocational-technical institutions, universities, and colleges. While this is true, the initiative which industry has taken in furthering the capabilities of the environmental/energy workforce has been an integral factor in preparing an apt workforce, ergo, this analysis.

National Field Research Center, Inc. (NFRC), began such a workforce examination for the U.S. Environmental Protection Agency in 1976 with Phase I of the National Environmental/Energy Workforce Assessment. Briefly, this study examined statistics pertinent to the number of individuals who were then in the environmental/energy workforce. Projective information from that study was designed to be valid through 1982 in the public sector. Adjunct to the evaluation of the public sector was an examination of the private sector. National Field Research Center continued its work for the Environmental Protection Agency with Phase II of a National Environmental/Energy Workforce Assessment – Post-Secondary Education Profile. Here, NFRC complemented an extensive mail survey and literature review with on-site interviews and pro-

duced a profile of the current activities related to post-secondary education.

During both Phase I and Phase II, contact persons made comments on the current status/stature of environmental education/energy education in the United States today. They stated their observations of the problems with these educational types, and made recommendations as to what improvements they would urge. This monograph is in answer to those issues. Its purposes here are threefold:

1. to describe the nature of environmental training activities in the private sector as identified during Phases I and II;
2. to describe the problems or issues which were identified during Phases I and II; and
3. to introduce additional areas to further thought and discussion.

The body will proceed in a manner commensurate with its objectives. It will first describe the participants, procedures, and findings of the Phase I and Phase II studies. This description includes a profile of the participants and consideration of the variables which resulted in their involvement with these projects. It continues with a section on the data gathering methodology, the

system for reporting, and a profile of the types of training being offered.

The next section of this monograph is the Review of the Literature. Library facilities were consulted for professional journals and periodicals, text materials concerned with in-house training, and specific academic training materials on environmental/energy topics. Research Analysts were at task to search out instances of pertinent model training activities.

Descriptions of project participant training activities follow. This section is organized respective of media, e.g., air, potable water, energy, and so forth. All of the modes of training which have been utilized by the participants are represented alongside the respective media with the nature of the company which utilized it.

Three issues were consistently brought forth by contact persons during Phases I and II. The first of these which were consistently mentioned is that of semantic inconsistencies. It was observed by those in the academic community as well as those in the private sector that there was little understanding of the inherent range of performance capabilities associated with one occupational title over those of another. The result of that misunderstanding, in broad terms, was that the academic sector felt under-

utilized and the private sector felt that the training priorities in the academic institutions were inappropriate, (i.e., in many instances they were seeking the same things but with different vocabularies – "A rose by any other name . . ."). Akin to the communication breach is the issue which was raised primarily by the private sector, that there is a tremendous need to align the pre-professional training regimens with de facto on-the-job skill requirements. Often times, the training which people receive is actually not appropriate for the occupational goal which they seek.

Finally, educators who were contacted during Phase II felt strongly that the private sector has a distinct obligation to participate in the preparation of its workforce. These educators expressed their frustration over what they perceive as a lack of interest in the preparation process, and a converse criticism of academic institutions for the actual content of this preparation. In one instance cited during a Phase II interview, the contact person described the process they had utilized for arriving at the skill set priorities which they assigned in their program. They prepared a questionnaire which offered industry the opportunity to rank the value of various skills (e.g., calculus, trigonometry, etc.). This survey formed one of the bases for the curriculum

which evolved. This contact person expressed considerable dismay over learning that even with a curriculum designed to the specifications of the regional industries, his graduates were still not being hired – and for the same reason, i.e., inappropriate training. This monograph seeks to provide recommended actions specific to each of the three issues.

The closing section provides a brief recap of the nature of in-house training which is available; it summarizes the issues alongside of the recommendations for remedial measures; and it identifies the avenues along which additional research projects of like kind could proceed.

SUMMARY OF PHASE I – PRIVATE SECTOR

Phase I researchers designed their endeavor so as to embrace four basic concerns; these were:

1. What method(s) should be used to obtain workforce information from employers?
2. What conditions affecting the private sector or attitudes of management personnel interfere with obtaining information which can be translated into reliable data?
3. What size and other characteristics should a sample have to be representative of the industrial sector? and,

4. How consistent are definitions of environmental personnel among the various segments of industry and the public sector?

The study conducted by National Field Research Center was designed to obtain information relevant to those four questions, and which might be used to formulate a sound basis and methodology for future studies. Quantifiable data were not sought as end products, but were viewed as: 1) indicators of the magnitude of the anticipated increase in the industrial environmental/energy workforce; and 2) measures of the feasibility of the survey approach used.

Thirteen hundred companies were contacted by way of a letter from the National Association of Manufacturers (NAM). These companies were notified of the forthcoming environmental workforce study and were invited to participate. NFRC made direct contact with 250 companies in the course of obtaining data for the National Environmental/ Energy Workforce Assessment.

Companies which accepted the invitation to participate in the study were categorized according to the number of employees on-site, the location (by state and federal region), and the products(s) or service(s) offered. Despite an abbreviated response

to the invitation to participate, a study sample of 75 concerns, which represented each of the ten Federal regions, companies employing from 100 to 1,000 persons, and one service (electrical utilities) and one product (chemicals) was decided upon. Rather than the Phase I private sector analysis being statistical in its emphasis, the compact sample size permitted researchers to place analytic priority on the descriptive elements within the sample. All of the conclusions and observations for the Phase I private sector workforce report were formulated from the responses of these 75.

Table I describes the nature of the companies included in the final sample, in addition to their geographic destributions.

TABLE 1

COMPANIES INCLUDED IN SAMPLE
BY CATEGORY AND REGION

Region	Electrical Utility	Chemical Utility	Other Utility	Other Product	TOTAL
I	1	0	0	2	3
II	2	2	0	2	6
III	4	2	0	5	11
IV	6	3	1	9	19
V	4	3	0	11	18
VI	2	0	3	2	7
VII	2	0	0	1	3
VIII	1	0	0	1	2
IX	1	0	0	1	2
X	2	0	1	1	4
TOTAL	25	10	5	35	75

The problem of small sample sizes in conducting this kind of study seems consistent throughout the literature. Coplon and Smith (1972) was the most comprehensive study at the time of the Phase I report in that it made, "the attempt to identify current and future (through 1975) jobs for professional or technical personnel in the EPA fields of air, water, solid waste, pesticides, noise, and radiation." The authors, in the section of their report which discussed study conduct obstacles, stated, ". . .the modest

size of the industrial sample reduces the number of national estimates which can be made and places those which are made in some doubt."

NFRC researchers collected information initially by way of telephone interviews and utilized a standard questionnaire to dictate format. Interviewers were to make note of any anecdotal information offered during the course of the survey. On-site interviews followed the initial telephone contacts. These interviews pursued points of the questionnaire in greater detail than was possible during the phone contact. More than merely reiterating the standardized information, interviewees were urged in the direction of expanding upon any aspect of the questionnaire, or in any matters related to industrial environmental personnel not yet considered.

The Phase I report provides specific information regarding the reported results. Generally, the following information was secured:

- –Environmental control personnel requirements were met primarily or wholly through transfer of existing personnel.
- –Where transfer was not an alternative, personnel were recruited from academic institutions.
- –Greater than half of the respondents stated that current training programs did not meet their needs.
- –All respondents indicated that new employee training is offered (some require it).

- A combination of government regulation and a changing technology cause new jobs to emerge in one-third of the industries.
- In terms of quantifiable data, responses range from that of an anticipated no-growth situation, to that of greater than 100% projected increase in environmental personnel through 1982.
- Most respondents explicitly cited the inability to anticipate changes in environmental regulations at the state and federal level as a source of a considerable error factor in their making workforce growth projections.

Three conclusions of the Phase I report are particularly germane to this monograph and are following:

- Respondent comments indicate an air of dissatisfaction with regulatory agencies because of the lack of clarity in communications with the private sector. This is stated as one of the reasons for the inability to provide accurate figures for environmental workforce requirements.
- The factors which affect anticipated changes in environmental workforce needs must be isolated and accounted for in future sample selections.
- THE DETRIMENTAL EFFECTS OF THE LACK OF GENERALLY RECOGNIZED AND COMMONLY ACCEPTED DEFINITIONS OF ENVIRONMENTAL CONTROL PERSONNEL ARE MOST APPARENT AS CONSIDERATION IS TURNED TO THE "TECHNICIAN" AND "OTHER" CATEGORIES. The resulting confusion

> is particularly injurious to the accuracy of projections if, as most indicated, the greatest potential for growth in environmental control personnel is at the technician level.

The third of the conclusions has particular importance in the discussion of the issues contained in this monograph.

The next section summarized the procedures and findings of the Phase II study.

SUMMARY OF PHASE II – PRIVATE SECTOR

The Phase II Private Sector report of the National Environmental/Energy Workforce Assessment (NE/EWA) describes 63 training programs found in a variety of businesses, trade and professional associations. These 63 were related to pollution control and abatement, environmental research and resource conservation. As with the balance of the multi-phased project, this segment addressed itself to the eight environmental areas of air, energy, noise, pesticides, potable water, radiation, solid waste, and wastewater. Another component of this study, which is concerned with educational/training programs in the same eight media in the academic community, is already described in the Background.

Four objectives directed the Phase II private sector effort; these were:

1. To solicit responses from the private sector describing their environmentally related training efforts in order to answer the basic question of "who" and "what/how" training is being done;
2. To describe these training efforts in brief summary form in order to determine how, with what types of materials, and in what depth people are being trained in the private sector;
3. To seek training programs in all eight environmental areas which provide the focus for the entire report; and
4. To provide primary source data on the relationship between academic training in environmental fields and subsequent employment of graduates in those fields.

Generally speaking, the response rates were rather promising. Initially, letters were sent to 229 businesses in the following industries: paper, utilities, coal, chemicals, oil, steel, airlines, cement manufacturing, and general manufacturing. Also included in the initial mailing were those companies most likely to be involved in pollution control activities of the Fortune 500. At the same time, a sample of 146 trade and professional associations received the initial inquiry for information about training activities. Please refer to Appendix 4 for a listing of organizations to whom letters were sent.

From the total mailing of 375 letters, 123 responses were received. Trade and professional associations accounted for 60 responses to 146 inquiries; 63 of the businesses responded from a total of 229. All of those organizations were represented in the Phase II report either in Program Summaries, if they described their programs, or in the appendices if they responded saying they had no pollution related training. One or more of the following three criteria had to be met for a program to be considered a training program, as defined for this study:

1. The materials associated with the training effort had to be either printed or audio-visual. If the program was so informal that no written materials existed to describe its content, it was not summarized for the report. On-the-job training was included only if it was a formal training program, i.e., it had some accompanying written materials.
2. Training had to be related in some way to one of the eight environmental areas being surveyed: air, energy, noise, pesticides, potable water, radiation, solid waste, and wastewater.
3. Training related to energy and resource conservation was considered viable.

The Phase II report contains detailed summaries of each of the participating organizations, but the following provides a selection of the types of courses which were offered:

–IN-HOUSE SEMINARS - Seminars conducted in-house which can include workbooks, pre and post tests, modules and users' manual (like those at Chevron and Pratt Whitney)

–IN-HOUSE CAMPAIGNS - In-house campaigns using posters, buttons, pamphlets, newsletters, and films such as the 3M programs and Scott Paper's Project DIET

–WORKSHOPS AND MEETINGS - Workshops and meetings prior to, or during annual membership conventions - See the Atomic Industrial Forum, Inc., program and the Institute of Noise Control Engineering

–COMPUTER MODELING PROGRAMS - Computer modeling programs for noise such as Chevron has used in plants and communities

–AUDIO-VISUAL TRAINING - Audio-visual training utilizing slides, sound filmstrips, tapes, and videotapes as described in the American Chemical Society and National Council of the Paper Industry for Air and Stream Improvement summaries

–CORRESPONDENCE COURSES - Correspondence courses such as that which the National Water Well Association offers

–CAREER DEVELOPMENT AND MOTIVATIONAL PROGRAMS - Unique career development and motivational programs such as the one designed by the Environmental Management Association

–SEMINARS FOR HIGH SCHOOL STUDENTS - Seminars designed to introduce high school juniors and seniors to environmental topics (like those by Arkansas Power and Light Company)

–EMERGENCY PREPAREDNESS SEMINARS - Strategy seminars such as are offered by Gulf Trading and Transportation Company

The post-secondary education profile of the private sector is ordered in three major categories. The first is a listing of programs which is specific to each of the eight designated EPA media. The participant organization is named under the respective category and under the company name is the title of the course(s) they offer. Next, in table form is a section which presents each company alphabetically and by medium, and again, the name of the course is shown below the company. Alongside each training course is provided the number of participants in the course annually; the length of the course; the instructional methods, media, and materials employed; and whether or not Continuing Education Units, college credits, or certification is awarded. The final

section of the report offers the companies alphabetically listed, each with a detailed summary of the program(s) they offer.

Even though the Phase I and Phase II endeavors were different in their respective content and objectives, there were several points of contention and intersection, which are the crux of this monograph.

REVIEW OF LITERATURE

Representatives of Environment Midwest (a Region V EPA publication), asked Brian Tabler what was the biggest problem that he had encountered in practicing environmental law. "The most frustrating problem is that it is well-nigh impossible for a state to develop Clean Air Act implementation plan control strategy revisions acceptable to EPA by reason of the fact that EPA's standards for supporting data are a moving target," Tabler responded.

This feeling is consistent with those of Phase I contacts (i.e., the hostility expressed toward regulatory agencies), that the penalties for not meeting regulatory directives are stiff, and yet the intents of such directives are often unclear – or changing. It becomes difficult/impossible to assess how many people will be needed to staff a project when the scope of that project cannot be readily or concisely discerned. Expanding upon that theme, it has been stated (Scott, 1978) that the enforcement of the Clean Air Act, "inevitably will trigger three very dangerous effects; it will:

1. weaken domestic industries and make us more dependent on foreign raw materials and foreign products;

*2. *cause more job opportunities to be exported;*

3. further weaken the dollar and make imports more difficult to pay for."

According to David Condon (Winter, 1978), since 1967, five industries (i.e., petroleum, chemicals, steel, paper, and non-ferrous metals) have accounted for greater than 40% of all required industrial spending on pollution control. Private sector capital-investment requirements for pollution control equipment could reach $112 billion over 1972-1981. Six industries (namely, non-ferrous metals, steel, paper, chemicals, petroleum, and electrical utilities) have allocated greater than 10% of their total plant equipment expenditures for pollution control and abatement from 1972 to 1976. Firms may have to invest $31 billion just to meet the 85 dB noise limit set by EPA.

Stepped-up environmental protection regulatory measures have brought substantial economic pressures to bear upon the functions of business and industry. The technical know-how requirements of the work-force have become increasingly specific and demanding in nature. There exist fields in which facilities have been equipped for pollution control activity, but whose operations are not fully operational

* emphasis NFRC's

because they cannot adequately meet their staffing needs. Lecht (1977) noted that the technological challenges are, "converting traditional natural-resource industries into research oriented industries; and affect the manpower needs accordingly."

Of course, shifts in national priority, as expressed through legislative activity, have strong impacts upon workforce needs; but establishing a "feel" for the extent of those needs appears to be the crux of the problem in achieving pollution abatement and control goals. It is widely accepted that the discontinuance of EPA training grant programs has critically affected the level of interest in various of the environmental fields on the part of prospective students; of particular mention have been air quality management and solid waste management programs.

Shortages of an available and adequately prepared workforce in some of these environmental fields has caused salaries to soar; however, "shortages are sure to bring unqualified people into the field and place them in positions that they are incapable of handling," (Hadeed, 1976). He continued to say, "If manpower shortages prevent pollution control legislation from being properly implemented, environmental groups that have supported such legislation may be unjustifiably criticized for the law's failure to fully achieve its objectives."

EPA's national appraisal of wastewater facilities found that more than 1,700 of them were not meeting removal requirements specified by the agency's secondary treatment definition. A 1976 EPA study found that, "inadequate laboratory capabilities and practices, nonexistent or inadequate O&M manuals, lack of training and poor routine maintenance programs are problems which must be remedied," (Hanlon and Reynolds, 1978). Further, "Everything that is needed in the fight to abate pollution of the nation's waters is available, except a sufficient number of qualified, trained personnel to operate and maintain the plants properly." Start-up and completion of so many new plants has caused acute shortages in the field for operators are way up.

An EPA study showed that of 120 plants, greater than 50% had staffs smaller than the recommended number. An OSHA survey (Vanderlinden, 1978) shows that of 130,000 plants surveyed, only 27% were within the 90 dB standard for noise levels, for a variety of reasons – workforce among them.

There seems to be consensus among those persons cited from the literature that the need for additional personnel with specific talents in the pollution control and abatement fields, and some effective means for determining the extent of that

need is great. S.J. Hadeed (July, 1976) said that a problem that exists in determining projected manpower needs stems, in part, from the, "increasing number of personnel employed by industry who are being re-trained and re-oriented towards pollution control activities. Through short courses and continuing education, these individuals can then be reassigned in-house to meet the pollution control needs of the industry." Given the antagonism toward, and frustration with the regulatory agencies that business and industry have frequently expressed, it is unreasonable to expect them to volunteer information regarding internal training activities without encouragement and solicitation.

In general terms, what kind of candidates are businesses and industries looking for? Environmental Midwest discussed employment outlooks for environmental careers with academicians, personnel directors in both public and private sectors, and executives in companies that do environmental work. "Almost all said the person who specializes in some applied or pure science, like sanitary engineering or aquatic biology, has an advantage over the environmental studies generalist when it comes to getting a job." The New York Times reported Eastman Kodak in Rochester, New York, as being primarily interested in air pollution, water pollution and solid waste

disposal; and looking for, "bachelor of science or master of science degree(s) in environmental engineering or a bachelor of science in chemical engineering with environmental courses."

Private sector contacts made during both Phases I and II of NFRC's National Environmental/Energy Workforce Assessment, affirm the contention that educators need to equip students with specific tools – master of one, rather than Jack of all. Thus, one can see the misgiving in the business and industry segment over the propensity of generalist programs, such as "environmental studies" or "environmental science" among academic institutions. Once again, the need for on-going dialogue between the consumers of trained/educated persons and representatives of the training/education institutions is made apparent.

DESCRIPTION OF PHASE II
PARTICIPANT TRAINING ACTIVITIES

It is helpful to see what actual training activities do go on in the private sector. This section of the monograph provides a listing of companies participating. The reader is advised that this listing is not intended to be exhaustive, but it should provide an adequate range of activities to allow insight as to the types of training which organizations in the private sector conduct.

The nine general types of training which have been described (i.e.,

1) In-house seminars
2) In-house campaigns
3) Workshops and meetings
4) Computer modeling programs
5) Audio-Visual training
6) Correspondence courses
7) Career Development and Motivational Programs
8) Seminars for high school students
9) Emergency Preparedness seminars),

are used variously by the private sector in their workforce preparation. Here, the titles of the training programs are listed with their respective organi-

zations to illustrate the approaches taken by the participants in this project.

The training programs/organizations are presented according to the nature of the subject material as it corresponds to EPA's broad classification, e.g., air, radiation, potable water, etc. In several instances, courses were pertinent to two distinct classifications, and, as such, should be represented twice; in such cases they bear an asterisk beside the course title in each category.

AIR PROGRAMS

Air Pollution Control Association
Refresher, Continuing Education Courses

American Industrial Hygiene Association
*Inhalation Toxicology Workshop

Asbestos Information Association/North America
Asbestos in the Atmosphere

Portland Cement Association
*Fundamentals of Occupational Noise and Dust Monitoring

COMPOSITE PROGRAMS

American Industrial Hygiene Association
Recognition of Occupational Health Hazards

composite cont'd

Arkansas Power and Light Company
- Conservation Seminars
- Lineman Training

Asbestos Information Association/North America
- Asbestos - Federal and State Regulations
- Recommended Practices for Handling Asbestos Fiber
- Recommended Work Practices for Use and Handling of Asbestos Products
- What You Should Know About Asbestos - and Health

Environmental Management Association
- Career Development and Registration Program

Minnesota Mining and Manufacturing (3M)
- Pollution Prevention Pays

Portland Cement Association
- Pollution Control Short Course

Westinghouse Electric Corporation
- The Westinghouse International School for Environmental Management

ENERGY PROGRAMS

American Institute of Plant Engineers
- Energy Conservation and Management Seminar

Columbus and Southern Ohio Electric Company
- Energy

W.R. Grace and Company
- Energy Conservation

energy cont'd.

Minnesota Mining and Manufacturing (3M)
Commute-A-Van
Energy Conservation Program

Mobil Oil Corporation
Modern Refining Technology

Portland Cement Association
Cement Chemists Seminar
Kiln Optimization Short Course
Mill Grinding Short Course

Scott Paper Company
Project DIET (A Decrease in Energy Today)

NOISE PROGRAMS

Anatrol
A Variety of Noise and Vibration Seminars

O.L. Angevine Associates
Noise Control Programs

Chevron Research Company, Standard Oil of California
COMNOI Computer Programs

Chevron, Standard Oil of California
AUDIO 1 Computer Program
Noise Control Guideline No. 3B

Institute of Noise Control Engineering
Inter-Noise '78

Harold R. Mull, Bell and Associates
Management of Noise Control in Industrial Plants
Noise Control in Manufacturing

noise cont'd.

Portland Cement Association
*Fundamentals of Occupational Noise and Dust Monitoring

POTABLE WATER PROGRAMS

American Public Works Association
*Sewer Rehabilitation
Urban Drainage
Wastewater Management and Operation

American Pulpwood Association
Logging and Soil/Water Protection in the Appalachian Forest
Southern Logging and Water Quality

Asbestos Information Association/North America
Asbestos in Water

Chevron Oil Company
Shipboard Oil Spill Prevention

Gulf Energy and Minerals Company
* Anti-Pollution Safety Device Training

Gulf Trading and Transportation
A Bad Day at Bunker Point

The Institute of Paper Chemistry
Microbiology
*Water and Wastewater Control
Water Quality and Aquatic Ecology

Mobil Oil Company
Oil Spill Prevention and Control Course

potable water cont'd.

National Council of the Paper Industry for Air and Stream Improvement
*Analytical Procedures for Bacteriological Analyses of Water and Wastewater
*Analytical Procedures for Measurement of Suspended Solids, Turbidity, and BOD
*Principles and Procedures for Water and Wastewater Color Measurement

RADIATION PROGRAMS

American Board of Nuclear Medicine (The Society of Nuclear Medicine)
Physician Certification in Nuclear Medicine

Atomic Industrial Forum, Inc.
Methods for Measuring Radiation In and Around Uranium Mills

Duquesne Light Company
The Beaver Valley Emergency Preparedness Plan

The Nuclear Medicine Technology Certification Board (The Society of Nuclear Medicine)
Nuclear Medicine Technologist Certification

Portland Cement Association
Level I - Inspection Technician (Nuclear)
Level II - Inspector (Nuclear)

Yankee Atomic Electric Company (University of Lowell)
Basic Radiological Health
Health Physics Certification Review

SOLID WASTE PROGRAMS

American Public Works Association
- Solid Waste Management
- Street Cleaning and Maintenance III

Automotive Dismantlers and Recyclers of America
- Various Materials Recycling

TOXIC SUBSTANCES (INCLUDING PESTICIDES)

American Industrial Hygiene Association
- *Inhalation Toxicology Workshop
- Toxicology Seminar

Chevron Chemical Company, Standard Oil of California
- Agricultural Chemical Emergencies, Spills, Fires

Columbus and Southern Ohio Electric Company
- Pesticides

Pratt Whitney Aircraft Group (United Technologies Corporation)
- *Chemical Waste Treatment

WASTEWATER PROGRAMS

American Public Works Association
- *Sewer Rehabilitation
- Troubleshooting O & M Problems in Municipal Wastewater Treatment Facilities

wastewater (cont'd.)

Consolidated Papers, Inc.
Secondary Wastewater Treatment Plant Operators Training

The Institute of Paper Chemistry
*Water and Wastewater Control

National Council of the Paper Industry for Air and Stream Improvement
*Analytical Procedures for Bacteriological Analyses of Water and Wastewater
*Analytical Procedures for Measurement of Suspended Solids, Turbidity, and BOD
*Principles and Procedures for Water and Wastewater Color Measurement

Pratt Whitney Aircraft Group (United Technologies Corporation)
*Chemical Waste Treatment

The reader is asked to note that if additional detail concerning the mode of course presentation is desired (e.g., the number of participants, instructional methods and materials, duration of the course, etc.) he/she may refer to the Phase II Post Secondary Education Profile - Private Sector, Table 6, pp. 43-77.

*Courses listed in more than one category.

ISSUES

Phase I and II interviewers noted mention of a variety of contentions, but three most consistently. As previously stated, they are:

ISSUE I: THE PROBLEM OF OCCUPATIONAL SEMANTICS;

ISSUE II: THE QUESTION OF APPROPRIATENESS OF ACADEMIC INSTITUTIONAL TAUGHT SKILLS TO THE ACTUAL SKILL REQUIREMENTS OF THE VARIOUS JOBS; AND,

ISSUE III: THE EDUCATORS FEEL THAT THE PRIVATE SECTOR IS NOT ADEQUATELY MEETING THEIR RESPONSIBILITY TO PARTICIPATE IN THE DETERMINATION OF TRAINING AND EDUCATION PRIORITIES.

National Field Research Center analysts developed recommendations for viable actions specific to each of the three issues. Although each issue is integrally related to the other, and they are parts of the whole of the topic of an environmental/energy they will be considered individually here.

ISSUE I: OCCUPATIONAL TITLES RAISE SEMANTIC ISSUES

> The difference between the almost right word and the right word is really a large matter - 'tis the difference between the lightning bug and the lightning.
>
> Mark Twain

Phase I and Phase II contacts indicated that one of the major difficulties confronting each sector in the consideration of an environmental/energy workforce, was the lack of confirmation of what skills sets are consistently associated with the various occupational titles. The private sector does not always have a clear view of what specific kind of personnel they are in need of (respective of the various titles), and the academic community does not always have a clear picture of what kind of training is appropriate to that need (or what title credential to award).

There are a number of lists enumerating the titles of occupations, among them is the Dictionary of Occupational Titles. These works provide a seemingly exhaustive repertoire of titles of occupations for every imaginable service or task. They do not, however, provide what is apparently needed in this interface area, i.e., conclusive definitions of each

of the occupational titles, complete with pre-work preparation (academically and experientially), and with an itemization of actual on-the-job skill demands.

The occupations, such as wastewater or water plant operations, which require professional certification do not often experience confusion over what those occupational titles mean, but in the early days of that licensing or certification procedure, a period of gradual acceptance was experienced. Certification examinations require the mastery of a set of skills basic to the practice of the job in question. Educators know in advance what to teach in these programs, and prospective employers know with certain assurance what abilities the certified operator may be expected to have. The certification process becomes a link between training and employment. Some kinds of certifications require specific courses which a person must have completed as a part of their certification eligibility. This protocol ensures interaction between educators and those persons in the certifying body, who, in turn, communicate with the private sector. With the professional credential comes an unstated résumé of specific skills and an understanding of a range of occupational potential. Furthermore, both students and prospective employees are able to identify goals in a concise way.

Without entering further into the pros and cons of certification, NFRC analysts suggest that the potential for a similar kind of mutual understanding exists, but not without a realistic frame of time of at least that which comes with instituting certification requirements. First, there is a need to enumerate skill sets and correlate appropriate training with appropriate job titles. The second need is to establish a range of skills which are specific to occupational titles, so as to describe the range of services which may be expected from one title in contrast with another.

The establishment of pre-determined sets of skills, being associated with particular occupational titles, should actively involve both the post-secondary educational institutions and the private sector. Each sector should identify those skills it values most highly in the performance range of a given task or occupation. One way to go about this would be to first create a list of environmental/energy occupations for representatives of each sector to examine, then with each occupational title provide a selection of tasks and skills most commonly associated with the job from which representatives of each sector may choose the most valuable. Finally, a meeting of the private sector with the training/education sector would offer the opportunity for a refinement of the

expectations and the preparations which would become associated with a particular title in a fixed or permanent way.

At the completion of such meetings it would be valuable to compile a dictionary of occupational titles and definitions for distribution among the private sector and the educational sector. A volume(s) such as this would allow training programs just getting under way a framework on which to base curricula development and it would define the expectations that a particular occupational credential might afford. This recommendation does not in any way call for certification in all of these areas. These meetings also lead into the involvement of each sector with the other on a regular basis, which, in turn, leads to Issue II.

ISSUE II: TRAINING NEEDS TO BE MATCHED WITH ON-THE-JOB SKILL REQUIREMENTS

ISSUE II interlocks with ISSUE I. There is always question as to the appropriateness of the skills which are taught in the classroom to the demands of the various environmental/energy occupations. Individuals in the private sector state that they feel the curriculum contents of these varied programs do not sufficiently address the actual

requirements of the tasks which need to be performed. They, in the private sector, feel as though they are left to complete the task of training at a much more basic professional level than should be necessary. Evidence of this opinion may be found in the regularity with which there is a preference for a basic professional degree over one which identifies itself as "environmental," for instance, Biology in preference to Environmental Biology. Often times, they have the fear that essential basics have been forfeited in the course of the modification process to an environmental emphasis. To breach that misgiving, the private sector will need to become more closely acquainted with curriculum content of programs related to their particular fields, and the educational sector will need to consult closely with the private sector to determine training priorities. Confidence in the credentials is likely only once they are well understood.

In conjunction with Issue I recommendations, great promise for achieving a mutual understanding of this sort exists if the people involved were to participate in the process of determining the criteria for awarding credentials. If the private sector helped to determine what skills would be appropriate/essential, and the educational sector were

made fully cognizant of these needs, then a systematic plan for course modeling would be off the ground.

NFRC analysts are of the opinion that if representatives of each sector were to take the lead or initiative with determining training priorities, then the appropriateness of skills to jobs would be assured. NFRC further recommends that a committee composed of both private and educational sectors be established and maintained to stay abreast of the training needs which are stimulated by changing technologies and occupational demands. The Introduction of this monograph cited an instance in which the educators had attempted to confer with the private sector in the determination of the skills which they would consider priorities in their curriculum development. Although their effort was not altogether successful, it was an initiative which must be taken and acted upon if training and employment are to coordinate their goals.

ISSUE III: EDUCATORS AND PRIVATE SECTOR NEED TO ALIGN PRIORITIES AND SYNCHRONIZE EFFORTS

The educational community charges that the private sector has been unreceptive to efforts to

ascertain what curricula priorities should be set if they are to bring training in line with occupational needs. Educators stated that they felt as though they had been misled on occasions, the result of which being an extremely limited market place in which graduates may locate employment.

Whatever the case, the private sector does have a responsibility to at least assist in defining the kind of personnel they are seeking; and the educational sector has the responsibility to respond to that call for an appropriately prepared workforce.

Standing committees for the purpose of monitoring the preparation of the environmental/energy workforce, here again, provide the best solution to the seeming discrepancy between the benefits to be derived from ongoing communication and an actual insufficient level of communication.

SUMMARY

The most obvious approach to each of the three issues is the development and maintenance of active lines of communication for the distinct purpose of aligning workforce preparation with workforce requirements. There is an apparent need for representatives of each concerned sector to sit down and

confer over the elements which each sector cites as the inadequacy with the others. There is need for the peculiar problems and features of the medium-specific workforce to be thoroughly considered.

NFRC suggests that a series of medium-specific conferences be held with participants representing education, business and industry, and government present. These conferences would have as their purposes:

a. the identification and discussion of issues confronting each sector;

b. the identification and discussion of impacts which each sector has to bear on the others;

c. the development of comprehensive definitions and descriptions for occupations in each of the respective media;

d. the compilation of these definitions into dictionary form;

e. the dissemination of information pertaining to these conferences to concerned persons in each of the sectors, possibly by way of a newsletter; and,

f. the regular convening of representatives of each of the sectors in order to maintain a high level of communication among them.

PROJECT COMMENTARY

Phase I sought to provide an overview analysis of private sector workforce needs and to develop workforce demand projections which would be effective through 1982. Phase II assessed post-secondary training activities and prepared profiles of them, and described training activities in the private sector related to pollution control and abatement, environmental research, and resource conservation.

Several points of contention and intersection were identified and discussed during interviews with Phase I and II contacts. Three issues dominated; these are:

1. the semantic inconsistencies which are found in occupational titles;
2. that training is not always appropriate to the on-the-job skill demands; and,
3. that educators feel that the private sector has an obligation to participate in the training plan and process.

It is believed that the best action to remedy semantic inconsistencies is to prepare a sort of dictionary of environmental/energy occupations for circulation among educators, private sector, and government. A series of conferences among these three factions would need to be conducted in order

to determine what specific skills in each medium would be best associated with a particular occupational title. This dictionary is envisioned as offering an outline of specific skill and experiential backgrounds which are most appropriately associated with a given job title. Hopefully, this reference will provide a source of clarity much like that which is achieved in the delineation of requirements that are understood for certified occupations.

Business and industry contacts made repeated mention of the feeling that often times academic preparation has little to do with the actual rigors of the job traditionally associated with it. They expressed skepticism over the aptness of content and quality in programs currently being labeled "environmental." Conversely, educators rather consistently expressed their opinion that business and industry has an obligation to participate in the preparation of its workforce, and further, that in the past that sector has fallen well short of their obligation.

Clearly, there is substantial need for frequent and cooperative dialogue to be established and maintained. Business and industry does have an obligation to participate in the preparation of its workforce, but training its personnel is not its ultimate purpose. The largest portion of the burden

of training rightfully belongs with educators. Additionally, educators have every right and reason to expect industry to detail explicitly the talents and qualifications it wishes its entry level personnel to possess. Educators must then act upon that information and prepare curricula which competently reflect responsiveness to the actualities of workforce requirements in the occupations related to the environment and energy.

Conferences among government, industry and educational factions might be conducted utilizing any number of formats. Regardless of the mode, however, the results of the meetings should be:

1. the establishment of sufficiently specific definitions of environmental/ energy related occupations which would enhance the understanding of the respective roles of the three factions (i.e., industry, educators, legislators);
2. the provision of a forum for identifying aspects of employment, education, and legislation which bring to bear on one another; and,
3. the establishment of a regular and ongoing dialogue among the participant factions.

APPENDIX 1

SAMPLE OF INFORMATION REQUESTED DURING PHASE I

Industry _____

Corporate Official _____

Title _____

Address _____

Phone _____

Major Product _____

Plant Location _____

_____

1. Pollution Control Effort: (Check as appropriate)

   Air ( ) Potable Water ( )

   Noise ( ) Radiation ( )

   Pesticides ( ) Solid Waste ( )

   Wastewater ( )

2. What is the current staffing level for your effort in _____ Pollution Control? _____

3. What professional/technical backgrounds are represented? (Provide numbers)

Position	1976
Engineers (by type where possible)	
Scientist (" " " ")	
Technician (" " " ")	
Other (" " " ")	

   (Administrators are to be included by profession. Clerical is not to be included.)

4. What are the principal activities of this program? (List them in sentence format.)

5. What is the approximate rate of employee turnover for this program?

6. What annual rate of staff growth/decline do you anticipate over the next five years?

Position	1977	1978	1979	1980	1981
Engineer					
Scientist					
Technician					
Other					

7. How do you meet employment requirements?

8. Do current training programs meet your program requirements? If not, explain.

9. Do you anticipate new or unique jobs emerging in your industry over the next five years as a consequence of regulations, advancing technology, or growing public awareness?

10. Do you offer training programs for new employees? (Explain in terms of frequency, duration, subject matter.)

11. Do you offer upgrade programs for on-line personnel? (Explain in terms of frequency, duration, subject matter.)

The preceding must be asked for each of the programs which the particular industry may have. The following questions are designed to provide supplemental analytical, though less quantifiable, data:

12. What past and continuing problems do you have with achieving acceptable environmental controls?

13. What has been the single greatest deterrent in your efforts to achieve what has come to be called "compliance with established pollution control levels?"

14. Briefly, if your company had the option how would it have achieved adequate controls?

APPENDIX 2

SAMPLE OF INFORMATION REQUESTED DURING PHASE II

A. TRAINING PROGRAM DESCRIPTION

1. In your organization, what types of occupations (titles) are directly related to pollution control?
2. Describe the training programs you conduct for these occupations.
3. Are there pollution control related occupations for which you don't train? _____Which ones? _____Why not? _____
4. Which institutions do an outstanding job of training for these positions?
5. How do you decide who needs to be trained?
6. Why do you feel it's necessary for you to do this type of training?
7. How long are your programs?_____ Where are they conducted? _____
8. Is the training budget for these positions a significant part of your overall training budget? _____What percentage? _____ Dollars?_____Or some indication of the organization's commitment to training?
9. Could/should this training be done elsewhere? (junior colleges, agencies)
10. How is your program unique or exemplary? Has anyone used it as a model for their program design? _____Who? When?

B. TRAINING STAFF

1. What is the size of the staff or department?
2. Do you have mostly degreed trainers or a mixture of technicians and trainers? _____ Ratio or description of staff.

3. Generally, what are the backgrounds of the training department personnel? _____
Do they come from other companies, in-house or other backgrounds?_____

4. Do you work with any universities or other agencies for training? Who? Where?

5. Do you do training outside of your own organization?

C. TRAINING MATERIALS

1. What types of training materials are used

2. How are the training materials obtained? (written in-house, commercially available)

3. Are your training programs available to other companies in the industry?

4. Are the materials all print or multimedia (films, video tapes, etc.)?

5. How long does it take to adapt a curriculum to a change in technology or staffing?

6. Have you ever used IRIS or ERIC?

D. TRAINEES

1. How many people are trained in pollution control related occupations each year?_____
Possible breakdown by occupation.

2. How is completion of a program measured? (time, criteria, testing)

E. OTHER

1. What training problems have been created as a result of EPA regulations?

APPENDIX 3

ORGANIZATIONS PARTICIPATING - PHASE II
PRIVATE SECTOR

Air Pollution Control Association
American Board of Nuclear Medicine
American Chemical Society
American Industrial Hygiene Association
American Institute of Plant Engineers
American Public Works Association
American Pulpwood Association
Anatrol Corporation
O.L. Angevine Associates
Arkansas Power and Light Company
Asbestos Information Association/North America
Atomic Industrial Forum, Inc.
Automotive Dismantlers and Recyclers of America
Chevron Chemical Company, Standard Oil of California
Chevron Oil Company
Chevron Research Company, Standard Oil of California
Chevron, Standard Oil Company
Columbus and Southern Ohio Electric Company
Consolidated Papers, Inc.
Duquesne Light Company
Environmental Management Association
W. R. Grace and Company
Gulf Energy and Minerals Company
Gulf Trading and Transportation Company
Institute of Noise Control Engineering
The Institute of Paper Chemistry
Minnesota Mining and Manufacturing (3M)
Mobil Oil Corporation
Harold R. Mull, Bell and Associates

National Council of the Paper Industry for Air and Stream Improvement

National Water Well Association

The Nuclear Medicine Technology Certification Board

Portland Cement Association

Pratt and Whitney Aircraft Group

Scott Paper Company

Texaco

Texaco and NUS Corporation

Westinghouse Electric Corporation

Yankee Atomic Electric Company

APPENDIX 4

ORGANIZATIONS CONTACTED - PHASE II

BUSINESS AND INDUSTRY

Alcoa Generating Corporation
Allegheny Ludlum Industries
Allied Chemical Corporation
Allis-Chalmers Corporation
Aluminum Company of America
Amerada Hess Corporation
American Color and Chemical Corporation
American Motors
Amstar Corporation
Amstar Refinery
Ashland Oil Company
Atlantic Cement Corporation, Inc.
Atlantic Richfield Company
AVCO Corporation
Bangor Hydro-Electric Company
BASF Wyandotte Corporation
Baxter Travenol Laboratories
Black Diamond Coal Mining Company
Blaw-Knox Company
Boise Cascade Corporation
Boston Edison Company
Bro Rad Laboratories, Inc.
Burlington Industries
Centex Corporation
Champion International Corporation
CIBA-GEIGY Corporation
Cities Service Company
Clark Oil and Refining Corporation
Colorado Interstate Gas Company
Commonwealth Edison Company of Indiana

Consolidated Coal Company
Co-operative Farm Chemical Association
Crown Zellerback Corporation
Daimond Coal Company
Diamond Shamrock Corporation
Dow Chemical Company, Inc.
E.I. DuPont DeNomours and Company
Energy Unlimited, Ltd.
Exxon Corporation
Firestone Tire and Rubber Company
Ford Motor Company
Gates Learjet Corporation
General Dynamics Corporation
General Electric Company
General Motors Corporation
Getty Oil Company
Great Lakes Chemical Corporation
Great Northern Nekoosa Corporation
Greyhound Corporation
Gulf Resources and Chemical Corporation
Hammermill Paper Company
Hooker Chemicals and Plastic Corporation
Hydro-Air Engineering, Inc.
Ideal Basic Industries, Inc.
Indiana and Michigan Power Company
International Harvester Company
International Paper Company
Iowa-Illinois Gas & Electric Company
Iowa Southern Utilities Company
Johnstown Coal Coke Company, Inc.
Jones and Laughlin Steel Corporation
Kansas Gas & Electric Corporation
Kentucky Carbon Corporation
Kimberly-Clark Corporation

Lake Hemet Municipal Water District
Lehigh Portland Cement Company
Lone Star Industries
LTV Corporation
Magna-Thermal Power Project
Maine Yankee Atomic Power Project
Marathon Oil Company
Marquette Company, Inc.
Martinc Marietta Corporation
Massachusetts Electric Company
McDonnell Douglas Corporation
McGraw-Edison Company
Medusa Corporation
Middle South Utilities, Inc.
Midwest Steel
Monsanto Company
National Gypsum Company
National Steel Corporation
Northrop Corporation
Nuclear Engineering Company
Occidential Petroleum Corporation
Ohio Edison Company, Inc.
Ohio Power Company
Olin Corporation
Owens-Illinois, Inc.
Penn Dixie Industries, Inc.
Pennzoil Company
Peoples Gas Company
Pfizer, Inc.
Phillips Petroleum Company
Pollution Control Industries
PPG Industries, Inc.
Quaker State Oil Refining Corporation
Raychem International Corporation

Rohr Industries, Inc.
St. Joe Minerals Corporation
St. Joe Paper Company, Inc.
Shell Oil Company
Sherwin-Williams Company
Skelly Oil Company
South Carolina Electric & Gas Company
South MIssissippi Electric Power Association
Southern California Water Company
Standard Oil Company of Indiana
Standard Oil Company, Ohio Corporation
Stauffer Chemical Company
Sun Oil Company
Teledyne, Inc.
Tenneco
Tennessee Consolidate Coal Company
Texas Utilities Company
Thompson-Hayward Chemical Company
Tri State Electric Membership
TRW, Inc.
Union Carbide Corporation
Union Oil Company of California
Union Pacific Corporation
Uniroyal, Inc.
United Nuclear Corporation
United States Radium Corporation
U.S. Steel
Vermont Yankee Nuclear Power Corporation
Virginia Electric Co-op
Waste Resources Corporation
Water and Waste Utilities Company
Water Works and Lighting Commission
Wausau Paper Mills Company
Westmoreland Coal Company

Westvaco Corporation
Weyerhaeuser Company
Wheeling-Pittsburgh Steel Corporation
Widefield Homes Water Company
Wisconsin Electric Power Company

TRADE AND PROFESSIONAL ASSOCIATIONS

Acoustical Society of America
American Coke and Coal Chemical Institute
American Fisheries Society
American Forestry Association
American Gas Association
American Institute of Biological Sciences, Inc.
American Institute of Chemists, Inc.
American Iron and Steel Industries
American Lung Association
American Mosquito Control Association
American Public Health Association
American Society for Engineering Education
American Society for Biological Chemists
American Society of Certified Engineering Technicians
American Society of Civil Engineers
American Society of Limnology and Oceanography
American Society of Sanitary Engineering
American Water Works Association
American Wood Preserves Institute
Associated Laboratories
Association of Air Pollution Control Equipment Manufacturers
Association of American Pesticides Control Officials
Association of Career Training Schools
Association of Consulting Chemists and Chemical Engineers

Association of Metropolitan Sewerage Agencies
Association of State and Interstate Water Pollution Control Administrators
Better Hearing Institute
Bituminous Coal Research, Inc.
California Redwood Association
Concrete Plant Manufacturers Bureau
Conference of Public Health Laboratory Directors
Conference of State Sanitary Engineers
Congress of Lung Association Staff
Cooling Tower Institute
Edison Electric Institute
Engineers Council for Professional Development
Environmental Action Foundation
Environmental Education Group
Environmental Mutagen Society
Federal Water Quality Association
Forest Industries Council
Forest Products Research Society
Foundry Equipment Manufacturers Association
Gas Processors Association
Ground Water Council
Industrial Gas Cleaning Institute
International Association of Heat and Frost Insulators
International Chemical Workers Union
Institute for Municipal Engineering
Institute of Advanced Sanitation
Institute of Environmental Sciences
Institute of Nuclear Materials Management
National Agricultural Chemicals Association
National Association for Environmental Education
National Association of Government Inspectors and Quality Assurance Personnel
National Association of Recycling Industries

National Association of Regulatory Utility Commissioners
National Council on Radiation Protection and Measurement
National Lead Burning Association
National Parks and Conservation Association
National Pest Control Association
National Shellfisheries Association
National Slaf Association
National Water Resources Association
National Water Supply Improvement Association
National Wildlife Federation
Natural Resources Defense Council
North American Thermal Analysis
Open Pit Mining Association
Portable Sanitation Association
Rachel Carson Trust for the Living Environment
Radiological Society of North America
Salt Institute
Society of Independent Professional Earth Scientists
Society of Mining Engineers of AIME
Society of Power Industry Biologists
Society of Toxicology
Soil Science Society of America
Solar Energy Industries Association
Threshold: An International Center for Environmental Renewal
Trout Unlimited
United Pesticide Formulators Distributors Association
U.S. Conference of City Health Officers
Universities Council on Water Resources
Water and Wastewater Equipment Manufacturers
Water Pollution Control Federation
Water Quality Association
Water Resources Congress

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